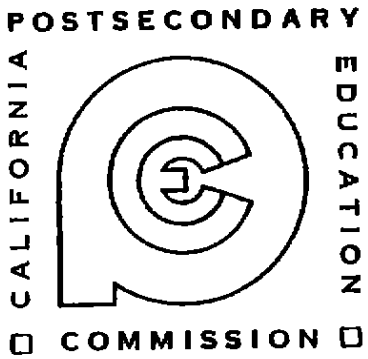
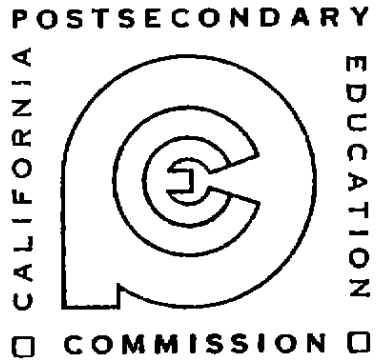
FUNDING IMPROVEMENTS IN MATHEMATICS, SCIENCE, AND COMPUTER EDUCATION AND RESEARCH



CALIFORNIA POSTSECONDARY EDUCATION COMMISSION

FUNDING IMPROVEMENTS IN MATHEMATICS, SCIENCE, AND COMPUTER EDUCATION AND RESEARCH

A Staff Report on the Use of Recent State Appropriations to Public Education for Specific Curricular Development



CALIFORNIA POSTSECONDARY EDUCATION COMMISSION
1020 Twelfth Street, Sacramento, California 95814

Commission Report 84-11

March 1984

CONTENTS

TABLES

INTRODUCTION

The 1982-83 State Budget appropriated $14.5 million to the University of California, the California State University, the California Community Colleges, and the State Department of Education designated for improvements in mathematics, science, and computer education and research. Each of these segments developed budget change proposals in 1982 defining how they could contribute most effectively to the achievement of this broad goal This report describes the nature, history, and current status of each segment's effort, its funding level, and, where appropriate, its success in securing matching support from business and industry.

UNIVERSITY OF CALIFORNIA

In 1982-83, the University proposed to increase the quality and extent of education in engineering, computer sciences, and related basic sciences by using its $1 million augmentation to acquire state-of-the-art instructional equipment and contribute support to programs designed to reduce attrition among women and ethnic minority undergraduates in engineering and computer sciences. The University allocated $875,000 in 1982-83 to its eight general campuses for state-of-the-art instructional equipment for advanced undergraduates in engineering, computer sciences, and related basic sciences. (The pervasive need for new and replacement instructional equipment in these fields was documented by the Commission in its June 1982 report, Engineering and Computer Science Education in California Public Higher Education.) Each of the general campuses received $20,000 plus a proration of the remaining $715,000 according to the number of upper division majors in engineering and computer sciences enrolled in Fall 1981. The remaining $125,000 for improving efforts to retain women and minority students enrolled in engineering and computer sciences were allocated to six campuses with the largest minority student enrollment in these areas (Santa Cruz and Riverside being the exceptions). For most of the six, the funds contributed support to Minority Engineering Programs which are college-level extensions of the Mathematics, Engineering and Science Achievements (MESA) student academic support programs, providing counseling and tutoring services.

While the University handled the 1982-83 allocation as temporary funds, it sought an augmentation of $1 million in these areas in 1983-84. That budget change proposal was denied, and the 1982-83 appropriation, adjusted for inflation, was approved for 1983-84 essentially for the same programs. However, subsequent required budget savings reduced the final 1983-84 allocation to $994,000 and this allocation became a permanent part of the University's budget. Table 1 shows funding levels by campus for equipment purchase and retention efforts in each of these years.

The 1984-85 Governor's Budget proposes the following augmentations "to restore the University's budget to a level that ensures the continued

excellence of its programs in the future" and ". . . strengthen the University's capacity to respond to student and societal demand for the development and expansion of programs in fields such as engineering, computer sciences, and other sciences" (page A-11).

- $12.3 million for instructional equipment,
- $4.0 million for instructional computing,
- $2.0 million for basic research and graduate education in microelectronics, computer sciences, and related fields,
- $0.5 million for graduate and professional student affirmative action programs, and
- $0.5 million for faculty affirmative action programs.

While these augmentations are not targeted at engineering, computer science and related sciences, these areas will benefit from them as part of the University's comprehensive effort to strengthen its total program. For the target areas, designated funding will continue at the same level in 1984-85 and beyond as a regular part of the University's budget.

TABLE 1 Budget Allocations Targeted for Instructional Equipment and Student Retention in Engineering, Computer Sciences, and Related Sciences at the University of California, 1982-83 and 1983-84

Campus	Equipment 1982-83	Equipment 1983-84	Retention Efforts Women and Minorities 1982-83	Retention Efforts Women and Minorities 1983-84
Berkeley	$213,000	$211,800	$27,000	$25,300
Davis	119,000	118,300	19,000	20,900
Irvine	103,000	95,400	12,000	8,500
Los Angeles	142,000	121,200	29,000	20,400
Riverside	27,000	27,800	--	--
San Diego	130,000	147,100	22,000	24,400
Santa Barbara	106,000	105,300	16,000	19,900
Santa Cruz	35,000	42,700	--	5,000
Total	$875,000	$869,600	$125,000	$124,400

Sources: Attachment to correspondence from David S. Saxon, President of the University of California, to William Hamm, Legislative Analyst, September 28, 1982, and personal conversation with Bonnie McKellar, Budget Office of the University of California.

THE CALIFORNIA STATE UNIVERSITY

In 1982-83, the State University proposed to enhance the quantity and quality of engineering and computer science graduates by increasing the productivity of existing programs through improvements in three areas -- (1) faculty and program development, (2) recruitment and retention of women and ethnic minority students in engineering and computer sciences, and (3) purchase of new and replacement instructional equipment. The State University received $2.25 million in 1982-83 for these purposes, which it allocated on the basis of competitive proposals submitted by its 16 campuses with existing engineering and computer science degree programs.

The request for proposals required each campus to specify the needs of its engineering and computer science programs, and show how it planned to address those needs while safeguarding program quality. The proposal was to include a listing of responsible staff, evaluation efforts, and statements of expected outcomes (measurable, if possible). In addition, the campus had to seek matching funds from industry to support the program and indicate its recent history of collaboration with industry in these areas. In 1982-83, 16 of the 18 campuses received funds, with Bakersfield and San Bernardino not included. The focus of their programs varied by campuses, and while all 16 did not seek funding in all three target areas, statewide allocations provided funding in each of the areas.

Faculty and Program Development

This target area refers to the broad spectrum of issues and problems related to staffing and curriculum development, including faculty and technical staff retraining, integration of computers into the engineering and sciences curricula, and the development of new laboratory courses in newly emerging specialized computer areas, such as computer graphics, materials engineering, energy conversion, and integrated circuit processing. Funding in this area totaled $835,900 or 37.5 percent of the funds available in 1982-83. All 16 campuses requested and received some award for activity in this area.

Improving the Recruitment and Retention of Women and Ethnic Minority Students in Engineering and Computer Science

Recognizing that women and minority students continue to be underrepresented in engineering and computer science, the State University encouraged campuses not only to apply some of the funds toward recruitment and retention of these students, but also to collaborate with existing retention programs, such as MESA and NACME (National Action for Minorities in Engineering). Other suggested activities in this area included stipend or fee waiver programs at the master's level to encourage women and minority undergraduates to continue their education, and enrichment programs, such as summer research activities to provide them with significant experience in actual research situations.

In 1982-83, the State University allocated $246,000 or 10.9 percent of the available funds to this area. Seven campuses received awards for these types of activities in 1982-83, and most of them established or expanded programs based on the Minority Engineering Program developed at California State University, Northridge which provides comprehensive services in tandem with MESA for the recruitment and retention of minority students in engineering. Three campuses also used portions of these funds specifically to support women in science and engineering programs

Purchase of New and Replacement Instructional Equipment

The increasing obsolescence of existing equipment detracts from the quality of students' educational experience, and insufficient equipment limits the number of students who can enroll in laboratory courses. Campuses seeking allocations in this area had to demonstrate historical commitment of their own funds for new and replacement engineering equipment and show maintenance of effort by expending from their own 1982-83 funds no less than the average amount expended over the previous three years. They were also expected to demonstrate success in getting equipment donations from industry on a matching basis. These campuses would be allocated funds up to the highest total expended for engineering equipment in any of these three years. Thus, these awards were to supplement and not supplant equipment support.

All campuses requesting funds in this area received an award in 1982-83. While the initial plan for expenditure proposed that one-third of available funds be allocated for equipment renewal or replacement, the demonstrated need was so pervasive and persuasive that 51.7 percent of the total available funds, or $1.163 million, were allocated in this area.

In 1983-84, the State University requested a $17.2 million budget augmentation to fund a comprehensive program to meet further instructional resource needs of the segment imposed by rapidly developing and changing technologies in engineering, business, and computer science. This request was not approved, and funding in this area was the same as the previous year. Table 2 summarizes funding in the three areas described above for these two years.

The 1984-85 Governor's Budget seeks "to restore the State University's budget to a level that ensures the continued excellence of its programs in the future" (page A-12). It includes over $17 million for high technology-related purposes, including $9 million for new and replacement instructional equipment, $3.4 million for technical staffing, $2 million for related supplies and services, and $5 million for instructional computing. In addition, it allocates over $1 million for faculty development, recruitment, and retention, with emphasis on engineering, computer science, business, and health services. In addition, the specific targeted funding discussed above will also continue in 1984-85 and the existing allocation method will remain in place.

TABLE 2 Budget Allocations Targeted at Engineering and Computer Science Programs at the California State University, 1982-83 and 1983-84, in Thousands of Dollars

Campus	Faculty and Curriculum Development 1982-83	Faculty and Curriculum Development 1983-84	Women and Minority Retention 1982-83	Women and Minority Retention 1983-84	Instructional Equipment Replacement 1982-83	Instructional Equipment Replacement 1983-84
Bakersfield	--	--	--	--	--	--
Chico	$141.7	$49.4	--	$10.3	$47.4	$105.8
Dominguez Hills	32.8	--	--	--	24.3	5.1
Fresno	6.5	2.0	--	20.4	64.8	47.3
Fullerton	53.0	18.7	25.0	25.0	53.3	113.2
Hayward	20.0	4.9	--	--	41.9	34.2
Humboldt	2.0	20.6	--	--	--	--
Long Beach	16.0	--	--	--	79.3	171.0
Los Angeles	17.4	--	32.3	28.5	53.4	76.3
Northridge	46.0	28.8	78.7	77.8	58.6	102.2
Pomona	115.0	45.7	30.0	41.3	114.3	173.0
Sacramento	60.0	21.2	25.0	20 4	136.0	131.8
San Bernardino	--	--	--	--	--	--
San Diego	115.0	52.5	25.0	21.4	118.2	116.0
San Francisco	30.0	13.2	--	--	32.8	30.6
San Jose	115.0	79.0	30.0	27.4	178.8	209.4
San Luis Obispo	65.5	24.8	--	23.4	110.4	224.4
Sonoma	--	1.8	--	--	19.1	19.2
Stanislaus	--	3.9	--	--	30.5	24.4
Total	$835.9	$366.5	$246.0	$295.9	$1,163.1	$1,583.7

Note: Systemwide Administrative Expenses in 1983-84 Totaled $3,900.

Source: The California State University, "Report on the Allocation of Funds Investment in People Program," Office of the Chancellor, November, 1982, and personal conversation with Jo Service, Office of the Chancellor, February 29, 1984.

CALIFORNIA COMMUNITY COLLEGES

For Community Colleges' efforts in technology and related areas, the 1982-83 State Budget provided a total of $2.0 million -- $100,00 for statewide administration and $1.9 million for the colleges to expand their employer-based training programs in high technology fields and to stimulate coordinated support for these programs through matching funds from federal, State, and private sources. The Community Colleges identified approximately $2.1 million from four such sources -- federal Vocational Education Act (VEA) funds, California Worksite Education and Training Act (CWETA) funds, locally generated private funds, and General Motors/United Auto Workers Training (GM/UAW) funds--to match this State support.

The Chancellor's Office of the Community Colleges established a competitive proposal program to allocate these funds. The general criteria required coordinated program planning by the colleges, districts, and local business and industry in high demand fields to provide short-term training that includes both classroom and worksite training that supplemented rather than supplanted existing offerings. Programs must demonstrate employers' commitment to hire participants who successfully completed the program. Each of the three major components, (1) new programs in high or emerging technologies, (2) private sector support for worksite-based training, and (3) retraining programs for displaced workers, had to conform to the general criteria and to its own specific criteria, but a proposal could include any combination of them.

New Programs in High and Emerging Technologies

Both student interest in high technology employment and business and industries' need for skilled workers in these fields have grown faster than State support for such programs. Support in this area helped colleges establish new high-technology programs based on specific employer needs and an on-the-job training model, such as that of CWETA. In 1982-83, $800,000 or 42 percent of the budget augmentation was allocated to support this component, with $900,000 of VEA, CWETA, private sector, and other public employment training funds also available as necessary

Private Sector Support for Worksite-Based Training

In addition to providing needed training, this component sought to further vital, on-going partnerships between Community Colleges and local business, industry, and labor. Funding under this component focused on communities with both high unemployment rates, concentrations of economically disadvantaged residents, and shortages of skilled labor to meet job demands, especially in high-technology industries. The 1982-83 allocation of $550,000 was matched equally by locally generated private-sector funds, CWETA, and GM/UAU funds as needed to support approved proposals in this category.

Retraining Displaced Workers

In the recent recession, unemployment due to plant closures and mass layoffs affected some California communities disproportionately more than others. This component established the basis to support worker-retraining efforts in communities most adversely affected by these economic trends. While proposals in this category had to conform to general funding criteria, they were to emphasize the development of programs in high-technology fields with high employment potential that built on existing skills of displaced workers and used existing resources and delivery systems rather than duplicating current courses or programs. Such resources include personnel information from business and industry regarding workers' existing skills, training needs, and employment opportunities, and other support activities provided by the Employment Development Department, the Department of Economic and Business Development, the Department of Rehabilitation, and the Department of Industrial Relations. The allocation in this category was $550,000, to be augmented by $275,000 from GM/UAW and other funds as available and needed.

In the first year of funding, the Chancellor's Office received 53 proposals, and funded 32 of them at 22 colleges from 18 districts. The $2 million appropriation for these activites continued in the 1983-84 Community College budget funding 25 continuation and 17 new programs, but relatively fewer resources were available for them from other sources because state-level CWETA and federal CETA funds had ended. Table 3 shows by district the 1982-83 projects and their allocations from the three targeted components and all other sources and the 1983-84 projects and their total State funding only.

TABLE 3 Budget Allocations Targeted at High Technology, Private Sector, and Displaced Worker Training in California Community Colleges, 1982-83 and 1983-84, in Thousands of Dollars

	1982-83					1983-84*	
District	No. of Projects	High Technology	Private Sector	Displaced Worker	Other Funds	No. of Projects	All State Funds
Allan Hancock	1			$31.4	$92.4	--	--
Foothill-DeAnza	2	$40.3	$40.3	51.1	1,120.0	3	$334.3
Glendale	1	9.5			237.9	2	236.7
Long Beach	1	36.9			6.4	3	102.1
Los Angeles	9	28.0	21.2	359.0	808.0	7	260.0
Los Rios	1	12.7			1.5	1	12.7
North Orange	2	134.3		21.3	376.1	2	153.7
Palomar	1	220.2			83.0	2	321.3
Peralta	2	31.5	114.5	31.5	757.1	3	307.7
Rancho Santiago	2	103.7			590.0	2	68.0
San Diego	1	14.7	14.7	14.7	85.5	--	--
San Jose	1			7.1	--	--	--
San Mateo	3	326.8	101.8		478.2	4	430.0
Sequoia	1	8.5			6 3	2	29.5
Sonoma	1	16.7			95.3	1	16.7
South County	1			44.3	16.3	--	--
Southwestern	1	9.4			137.3	1	107.2
Ventura	1	20.1	20.1		142.0	3	133.1
Bakersfield						1	95.9
Fremont-Newark						2	97.6
Napa						1	48.8
Saddleback						1	43.6
Santa Monica						1	69.2
Total	32	$1,013.3	$312 6	$560.4	$5,033.3	42	$2,868.1

*For 1983-84, only total State allocations to each district are displayed because individual allocations are not currently available and the amount of private-sector, matching funds is not yet known.

Source: Chancellor's Office, California Community Colleges, "Report to the Legislature on the Investment in People Program, 1982-83," February 1, 1984, and Agenda of the Board of Governors of the California Community Colleges, Item 10, October 27-28, 1983, Appendices A and B.

The Governor's Budget for 1984-85 maintains the appropriation level of $2 million for these programs but provides no augmentation for training programs in high technology fields nor provides general funding enhancements for new or replacement instructional equipment as is the case in the budgets of the two four-year institutions

CALIFORNIA STATE DEPARTMENT OF EDUCATION

In an effort to improve the quantity and quality of mathematics and science instruction in California's public high schools, the 1982-83 State budget included $9.35 million of new monies designated for staff development, primarily in mathematics and science teacher development and, secondarily, in curriculum improvement. The State Department's program had four major components -- (1) Teacher Education and Computer Centers, (2) School Personnel Staff Development, (3) Bilingual Teacher Training Centers, and (4) Instructional Development and Exemplary Programs. Components within several of these four areas had specific ties to higher education.

Teacher Education and Computer Centers

Through a combination of new funds and redirected money from the School Resource Centers and Professional Development and Program Improvement Centers, fifteen regional Teacher Education and Computer (TEC) Centers were established. These 15 TEC Centers have the responsibility to provide their regions with the services formerly provided by the other two centers including staff and curriculum development and in-service teacher training, as well to serve as computer demonstration centers for the schools.

School Personnel Staff Development

New funds available in this component either supplemented school staff development programs initiated under AB 551 or funded new programs at schools that wished to apply. Because of the limited amount of these funds, priority was given to grades 7-12, providing $7.00 per ADA for approximately 25 percent of the schools with these grades in each region. These funds were to be used for teacher retraining, including costs of substitutes, fees and travel expenses for training or visits to exemplary programs, stipends for summer training, and purchase of materials to carry training into the classroom. Two-thirds of the funds were used for staff development related to mathematics, sciences, and the use of computers. Up to 25 percent could be used to purchase instructional materials for teachers to use in their classrooms. The TEC Centers have administered these funds, established procedures for their distribution, and monitored their effects.

Bilingual Teacher Training Centers

Funding provided for the implementation of nine centers as described in the Bilingual Teacher Training Assistance Program of AB 1379 (Chapter 1169 of the Statutes of 1981). These centers assist bilingual teachers to achieve full certification.

Instructional Development and Exemplary Programs

The Council on Technology Education, established by AB 3266, had responsibility for implementing this component, but the distribution of nearly half of the $2.3 million available to it was specified in the budget or other legislation. Of this half, MESA received $800,000, subject to MESA's private-sector matching funds requirement The TEC Centers received $100,000 for Computer Institutes to help them establish their computer laboratories and demonstration programs and the Institute for Computer Technology received $100,000 to develop a model program of computer use in K-12 classrooms.

The Council on Technology Education divided the remaining $1.26 million into two halves -- one to fund the California Mathematics Project (described in detail in the Commission's report 84-7 of January 1984) and the other to fund its own program of grants to fund exemplary intersegmental projects in one or more of the following areas: summer retraining programs for teachers; demonstration programs in schools; programs to encourage students to continue the study of mathematics and science throughout high school; and curriculum improvement in mathematics, sciences, or computer use in schools.

The State Department's funding for these programs continued in 1983-84 but other categorical programs subsumed these four components. The Hart-Hughes Act (SB 813) provided authorization and funding for the TEC Centers with only minor changes in their responsibilities. The 1983-84 Budget Act transferred approximately $630,000 designated for the California Mathematics Project from the State Department to the University of California, which had administrative responsibility for this project under the enabling legislation. AB 803 reorganized the administration of responsibilities and funding formerly under the province of the Council on Education Technology, which was dissolved.

The 1984-85 budget proposed by the Governor includes substantial augmentations for teacher retraining, but its implications for continuation of the cooperative relationships among schools, districts, counties, the Department, universities, business, industry, and labor for the improvement of mathematics and science education in the State's public schools have yet to be clarified.

CONCLUSION

In the early years of this decade, enrichment funding for education was very scarce due to a declining economy, tax-cutting measures, and their affect on State resources. In 1982-83, the only major budget augmentation approved for education targeted funds for improvements in mathematics, sciences, engineering, and computer sciences in all segments. In the current budget

year, funding for these improvements was continued at a similar level and became an on-going part of the segments' regular budgets.

By mid-1983, the economy showed substantial improvement with most economic projections pointing toward continued growth through the next fiscal year. With the expectation that State resources will also improve, the Governor has proposed substantial augmentations to fund the first steps in a broad-based effort to ensure the continued excellence of all programs at the University and State University. While targeted funding in the areas discussed in this report will continue, the proposed budget moves in the direction of establishing a more reasonable level of basic State support in all areas, limiting the necessity of special assistance in specific areas for which the State has fundamental responsibility for and interest in supporting.